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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/765,171	01/28/2004	Han Sup Uhm	Uhm 04-1	9849

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EXAMINER	
MCDONALD, RODNEY GLENN	

ART UNIT	PAPER NUMBER
1753	

MAIL DATE	DELIVERY MODE
08/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/765,171	UHM ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-12 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-12 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shaffer (WO 02/092506 A1) in view of Phillips et al. (U.S. Pat. 6,998,103), Moisan et al. (U.S. Pat. 6,916,400) and Okamoto et al. (U.S. Pat. 5,086,255).

Regarding claim 1, Shaffer teaches an apparatus for continuous and mass synthesis of carbon nanotubes. Shaffer teaches a discharge tube where an additional energy source is locally applied. Such a source can be plasma discharge (Page 9 lines 1-10) Reactant gases can be injected in a multiport. A preferred option is to introduce the precursor from an inlet in the side wall of the main stream, so, ideally the precursor

nozzle is fashioned to turn the injection flow parallel to the main feedstock flow, either downstream or upstream. The latter option can be advantageous with regard to turbulent mixing. (Page 10 lines 21-26) The gas can be a carbon containing gas with a metal catalyst. (Page 3 lines 18-30; Page 4 lines 1-3) Carbon nanotubes can be produced. (Page 10 lines 5-7) The gases pass through a furnace 16. (Page 14 line 4) A collector system for quenching and collecting the carbon nanotubes. (Page 14 lines 15-19)

Regarding the gas injection system comprising a plurality of swirl gas inlets (Claim 5), Shaffer teach the gas injection system including a plurality of swirl gas inlets. (Page 10 lines 19-26)

Regarding claim 6, Shaffer teaches that the furnace is capable of operating at a temperature range of 650 to 1250 degrees C. (Page 6 lines 26-28)

Regarding claim 7, Shaffer teach a process for continuous and mass synthesis of carbon nanotubes by utilizing plasma discharge and a furnace to form a carbon nanotube material. Shaffer teach injecting gas to create a turbulent flow (i.e. swirl) in a dielectric tube (i.e. quartz). (Page 10 lines 19-26; Page 14 line 1) A plasma discharge can create an intense electric field in the turbulent gas in the dielectric discharge tube. (Page 9 lines 1-10) The reaction takes place at atmospheric pressure. (Page 9 lines 11-14) A vaporized metal catalyst or metal catalyst precursor and a carbon-containing gas is introduced. (Page 3 lines 18-30; Page 4 lines 1-3) The material is reacted in a turbulent flow of gases. (Page 10 lines 19-26) The resulting gas is passed through a

furnace. (Page 14 lines 1-5) Carbon nanotube materials are quenched and collected in a collector system. (Page 14 lines 15-19)

Regarding claim 9, the carbon nanotubes that can grow at a temperature of 600 to 1200 degrees C. (Page 6 lines 26-28)

Regarding claim 10, the transition metal catalyst is atomized at a pressure of 1 atmosphere. (Page 9 lines 11-14)

Regarding claim 11, the carbon containing gas is mixed and injected with the swirl gas. (Page 10 lines 19-26)

Regarding claim 12, the metal catalyst or metal catalyst precursor is injected through one auxiliary inlet port and is atomized at a temperature of 600 to 1200 degrees C. (Page 10 lines 19-24; Page 6 lines 26-28)

The differences between Shaffer and the present clairns is that utilizing as the plasma discharge means a microwave radiation generator for forming a microwave plasma torch is not discussed (Claim 1), an ignition device is not discussed (Claim 1), the microwave plasma torch capable of operating at 2.45 GHz and at a power range of 0.1 to 6 kW with the assistance of auxiliary ignition systems is not discussed (Claim 2), the furnace being horizontally connected to the microwave plasma torch is not discussed (Claim 3), the length of the furnace is not discussed (Claim 4), utilizing microwave energy to produce the carbon nanotube is not discussed (Claim 7), utilizing a magnetron propagated through a tapered rectangular waveguide is not discussed (Claim 7) and forming an atmospheric pressure plasma torch is not discussed (Claim 7).

Regarding utilizing as the plasma discharge means a microwave radiation generator for forming a microwave plasma torch (Claim 1), Phillips et al. teach a plasma discharge means in the form of a microwave radiation generator for forming a microwave plasma torch to form nanotubes of carbon. (See Abstract; Column 3 lines 29-39)

Regarding an ignition device (Claim 1), Phillips et al. teach igniting the plasma torch. (Column 3 lines 40-50) Moisan et al. teach utilizing a wire rod for igniting a plasma torch. (Column 6 lines 17-24)

Regarding the microwave plasma torch capable of operating at 2.45 GHz and at a power range of 0.1 to 6 kW with the assistance of auxiliary ignition systems (Claim 1), Phillips et al. teach operating the microwave at 2.45 GHz and at a power of less 1.5 kW. (Column 3 lines 29-39) Moisan et al. teach utilizing a wire rod for igniting a plasma torch. (Column 6 lines 17-24)

Regarding the furnace being horizontally connected to the microwave plasma torch (Claim 3), Phillips et al. teach utilizing a microwave plasma torch. (See Phillips et al. discussed above) Shaffer teach locating the furnace horizontally. (See Figure 4)Regarding the length of the furnace (Claim 4),

Regarding utilizing microwave energy to produce the carbon nanotube (Claim 7), Phillips et al. teach utilizing microwave energy to produce carbon nanotubes. (See Abstract)

Regarding utilizing a magnetron propagated through a tapered rectangular waveguide (Claim 7), Okamoto et al. teach utilizing a tapered waveguide for producing microwave plasma. (Column 3 lines 40-44)

Regarding forming an atmospheric pressure plasma torch (Claim 7), Shaffer discussed above teach producing plasma at atmospheric pressure. (See Shaffer discussed above) Phillips et al. teach a microwave plasma torch. (See Phillips et al. discussed above)

The motivation for utilizing the features of Phillips et al. is that it allows for producing carbon nanotubes. (See Abstract)

The motivation for utilizing the features of Moisan et al. is that it allows for igniting the plasma. (See Moisan et al. Column 6 lines 17-24)

The motivation for utilizing the features of Okamoto et al. is that it allows for delivering microwaves. (Okamoto et al. Column 3 lines 40-44)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Shaffer by utilizing the features of Phillips et al., Moisan et al. and Okamoto et al. because it allows for producing carbon nanotubes, igniting the plasma and delivering microwaves.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-TH with every Friday off..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
August 22, 2007